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(54) (Title of Invention) Information Recording and Reproducing Device

(57) (Summary)

(Purpose)

This invention has its purpose in realizing a VTR which is capable of recording and reproducing both the analog signal and the digital signal on the same recording medium.

(Constitution)

A circuit for carrying out a prescribed recording signal processing for each signal is provided and a control signal having a prescribed polarity changing point is generated for each signal to be recorded on a tape. At the time of reproduction, the difference in the polarity changing point of the said control signal is detected and the reproducing signal processing is switched.

(Effect)

In the case where the signals of different kinds have been recorded on the same recording medium, the signal is discriminated on an automatic basis at the time of a replay, with the reproduction signal processing being switched. Accordingly, it has the effect of offering a VTR which can be conveniently used by the user.

(Translator's Note: Insert Figure 1 on p. (1). 20. Recording system digital signal processing. 30. Recording system analog signal processing. 40. CTL generation. 65. Servo. 60. (Translator's Note: Four characters are illegible) ... 70. Replay system digital signal processing. 80. Replay system analog signal processing.)

(Scope of Claims for Patent)

(Claim 1)

An information recording and reproducing device for carrying out recording and reproducing on a magnetic recording medium by a rotary magnetic head, comprising an analog signal processing means of the recording system for carrying out a prescribed recording signal processing on an incoming analog signal, a digital signal processing means of the recording system for carrying out a prescribed recording signal processing on an incoming digital signal, a means for producing a control signal that will become a reference signal for the servo, a means for recording

and reproducing the said control signal on a magnetic tape, a means for carrying out the discrimination of the data which have been recorded from the reproduction control signal, an analog signal processing means of the reproduction system for carrying out a prescribed reproducing signal processing on an analog signal that has been reproduced, and a digital signal processing means of the reproduction system for carrying out a prescribed reproducing signal processing on a digital signal that has been reproduced, characterized in that, at the time of recording, the recording signal processing is carried out by the said prescribed recording signal processing means in conformity with the input signal and a control signal having a prescribed polarity changing point which is in conformity with each of the signals that are to be recorded is recorded and, at the time of a replay, the means for carrying out the discrimination of the data that is recorded as described above carries out the discrimination of the recorded data by detecting the polarity changing point of the control signal that has been reproduced, switches the replay signal processing means on the basis of the said discrimination result, thereby carrying out the prescribed reproducing signal processing.

(Claim 2)

An information recording and reproducing device as described in Claim 1, characterized in that the prescribed polarity changing point of the said control signal differentiates the edge position which is opposite to the edge which is used in the standard for servo control.

(Claim 3)

An information recording and reproducing device as described in Claim 1, characterized in that the recording range on the magnetic medium of the said control signal is not changed even in the case where the said recording signal is an analog signal or in the case where the said recording signal is a digital signal.

(Detailed Explanation of the Invention)

(0001)

(Field of Industrial Utilization)

This invention relates to an information recording and reproducing device which is capable of recording both analog signals and digital signals in a mixed state on one single recording medium by a rotary magnetic head that scans the magnetic tape.

(0002)

(Technology According to Prior Art)

The video tape recorder (VTR) which is used in the recording and replaying of such information signals as the color video signal, etc. has already found its place in various households. The VTR for household use is a VTR of the so-called analog recording system (VHS, etc.).

In the broadcast busiess, on the other hand, the VTR of the digital recording system has started being used for commercial use. As the VTR of the digital recording system, there are those of the D1, D2 and D3 formats, which are currently being used at the broadcast stations. It is belived that such VTR technology for broadcasting business will eventually find its way for use as the VTR for household purposes.

(0003)

Along with the development of the digital circuit, moreover, various kinds of digital service are being promoted, with a VTR that can take care of the digital video information service being demanded. In such a case, it is believed that the digital system is better suited for such a purpuse for recording.

(0004)

When the various points described above are taken into

consideration, it is believed that the VTR to be used in various households for the next generation will be the digital recording system. If a VTR which is exclusively for digital recording is made, however, it will become necessary for the user to purchase the said digital VTR in addition to the conventional analog VTR, thereby imposing a greater financial burden on the user. In addition, there will be a need for the control of tapes, etc., thereby further complicating the procedures.

(0005)

Accordingly, it appears to be highly convenient if there is a VTR capable of analog recording and reproducing in accordance with the said conventional system and, at the same time, digital recording and reprocucing in conformity with the digital video service, Nevertheless, such a VTR has not as yet been introduced to the market.

(0006)

(Problem to be Solved by the Invention)

In the case of such a VTR capable of analog recording and digital recording as described above, it is desirable for the analog recording and digital recording to be carried out on the same recording medium from the standpoint of the user's conveneince.

The purpose of this invention lies in offering a VTR which can be conveniently used for the mixed recording of the analog system and the digital system on the said same recording medium and which, at the time of replay, can automatically discriminate the recording system for reproduction.

(0007)

(Means for Solving the Problem)

For the purpose of realizing the above-described objective, the information recording and reproducing device according to this invention has a signal processing system of the digital recording system in addition to the conventional analog recording system. In addition, it has a means for recording the recording mode along with the control signal that serves as the standard for the servo at the time of reproduction. At the time of reproduction, it automatically discriminates the signal that has been recorded from this information.

(0008)

(Function)

According to the VTR of this invention, a recording signal processing is suitably selected in conformity with the signal that is being recorded for signal processing. In addition, a prescribed control signal is recorded in conformity with the signal that is being recorded. At the time of reproduction, the control of the servo is carried out by the reproduction signal of the said control signal and, at the same time, the recording signal is discriminated and the replay signal processing is automatically selected and carried out in conformity with the same.

(0009)

(Example)

An example of this invention will be explained below by referring to Figure 1.

In Figure 1, numeral 1 indicates an input terminal of a signal that is to be recorded, 10, 11, 12, 13 and 14 are switching circuits, 20 is a digital signal proeessing

circuit of the recording system for carrying out digital modulation as well as the addition of an error correcting code at the time of the recording of a digital signal, 30 is an analog signal processing circuit of the recording system for carrying out such signal processings as the FM modulation, etc. at the time of the recording of an analog signal, 40 is a control signal generating circuit for the production of a prescribed control signal in conformity with the recording signal, 45 is a control head for carrying out the recording and reproducing of a control signal, 52 is a magnetic tape, 53 and 53' are magnetic heads, 57 is a reproduction amplifier.

In addition, numeral 60 indicates a discriminating circuit for the discrimination of a signal that is being recorded from the control signal that has been reproduced, 70 is a digital signal processing circuit of the replay system for carrying out digital modulation or error correction at the time of the reproduction of a digital signal, 80 is an analog signa processing circuit of the replay system for carrying out such a signal processing as the FM modulation, etc. at the time of the reproduction of an analog signal, and 5 is an output terminal of the reproduction signal.

(0010)

An information signal to be recorded is inputted from the input terminal 1. As the information sighals that are to be recorded in this system, the color video signal and the digital video signal that is supplied from the digital circuit are conceivable. Asthe digital circuits, the satellite broadcast, telephone circuit and cable television, etc. are conceivable.

(0011)

Let us first explain the recording in the case where the input signal happens to be an analog signal. The analog signal that has been inputted from the input terminal 1 is sent to a switching circuit 10. The switching circuit 10 switches the input signal in such a way as to be connected to the analog signal processing circuit 30 of the recording system. The signal that has been inputted to the analog signal processing circuit of the recording system is given a prescribed recording signal processing. As an example, it will be the system which is being used for the household VTR (VHS system). It is a system whereby a color signal is separated into a luminance signal and a chrominance signal, with the luminance signal being FM modulated and the chrominance signal being low-range converted, followed by superimposition on the luminance signal that has been FM-modulated.

The analog recording signal that has been signal-processed as described above at the analog signal processing circuit 30 of the recording system is sent to a switching circuit 11. The switching circuit 11 switches the output of the analog signal processing circuit 30 of the recording system in such a way as to be connected to the recording amplifier 50 and the said analog recording signal is sent to the magnetic heads 53 and 53' through the recording amplifier 50.

The magnetic heads 53 and 53' are arranged in opposition to each other at 180 degrees, to cite an example. The magnetic tape 52 is one which is wound on a cylinder by more than 180 degrees and the recording signal is recorded on the magnetic tape 52 by the magnetic heads 53 53'.

Here, the cylinder 55 and the magnetic tape 52 are controlled to a prescribed cylinder rotation number and tape forwarding speed by a servo control circuit 65. The control signal generating circuit 40 produces a prescribed control signal which is in synchronization with the signal that has been inputted to be sent to a switching circuit 14.

The switching circuit 14 switches in such a way that, at the time of recording, the control signal generating circuit 40 and the control head 45 may be connected. The control signal that has been outputted from the control signal generating circuit 40 goes through a switching circuit 14 and is recorded on the magnetic tape 52. This control signal is used for servo control at the time of replay.

(0012)

Servo control will be explained by referring to Figure 2. The recording control signal (refer to Figure 2(a)) which is in synchronization with the analog input signal (refer to Figure 2(1)) is produced at the control signal generating circuit 40 and is recorded on the magnetic tape 52. This control signal is used as the reference signal for the rotation phase of the cylinder 55 at the time of replay.

A pulse generator PG is installed at a location which is 180 degrees shifted even though it is not shown in the drawing, to be used for the detection of the rotation phase of the cylinder 55 and the output switching signal of the magnetic heads 53 and 53'. The detection pulse of the said PG is shown in Figures 2

(3) and (4). From this detection pulse, the head switch signal shown in Figure 2(5) is produced so as to carry out the output switching of the magnetic heads 53 and 53'.

The control signal (refer to Figure 2(6)) that has been reproduced by the control head 45 is waveform-restored to become a replay control signal (refer to Figure 2 (7)). The servo control circuit 65 acts in such a way as to maintain the said PG detection pulse and replay control signal in a prescribed relationship. At this time, the replay control signal that serves as a reference signal uses only one edge such as the stand-up edge in the example shown in Figure 2, for example.

(0013)

Next, the reproduction signal processing for an analog signal will be explained. The outputs of the magnetic heads 53 and 53' are sent to the switching circuit 12. Meanwhile, the reproduction control signal from the control head 45 is inputted to the discrimination circuit 60 and the servo control circuit 65 through the switching circuit 14.

The siwtching circuit 14 switches in such a way as to be connected at the control head 45, the discriminating circuit 60 and the servo control circuit 65 at the time of reproduction. At the discriminating circuit 60, the kind of the signal that is recorded from the replay control signal is discriminated and the servo control circuit 65 carries out the prescribed tape forwarding speed and cylinder rotation n umber, etc. in conformity with the result obtained above and the replay control signal. The action of this discriminating circuit 60 will

be described in detail later.

As the result of the above-described discrimination, the switching circuit 12 works in such a way as to connect the reproduction amplifier 57 and the analog signal processing circuit of the replay system and the switching circuit 13 switches in such a way as to connect the analog signal processing circuit 80 of the replay system and the output terminal 5.

The replay analog signal is inputted to the analog signal processing circuit 80 of the reproduction system and carries out a prescribed reproduction signal processing or a signal processing which is opposite to what takes place at the time of recording. After the luminance signal and the chrominance signal have been separated, the luminance signal is FM-modulated and the chrominance signal is frequency-modulated to be synthesized with the luminance sugnal once again.

The reproduced analog signal that has been reproduction signal processed as described above is outputted from the output terminal 5 through the switching circuit 13 from the analog signal processing circuit of the reproduction system.

(0014)

Let us explain the case of digital recording next. A digital signal that has been inputted from the input terminal 1 is inputted to a switching circuit 10. The switching circuit 10 switches in such a way as to be connected to the digital signal processing circuit of the recording system and the said digital input signal is sent to the digital signal processing circuit 20 of the recording system.

The signal that has been inputted to the digital signal processing circuit 20 of the recording system is given a prescribed recording signal processing or the addition of an error correction code as an example to undergo a signal processing for digital modulation, with a result that a digital recording signal is produced. The digital recording signal that has been processed at the digital signal processing circuit 20 of the recording system is sent to the switching circuit 11 and the switching circuit 11 switches in such a fashion as to connect the said digital recording signal to the recording amplifier 50, the said digital recording signal is sent to the magnetic heads 53 and 53' through the recording amplifer 50 to be recorded on a magnetic tape 52.

In the above case, the magnetic tape 52 is controlled to the prescribed cylinder rotation number and tape forwarding speed by the servo control circuit 65. In addition, the control signal generating circuit 40 produces a prescribed control signal which is in synchronization with the signal that has been inputted and sends it to the switching circuit 14.

At the time of recording, the switching circuit 14 switches in such a way as to connect the control signal generating circuit 40 and the control head 45. The control signal that has been outputted from the control signal generating circuit 40 is recorded on a magnetic tape 52 by the control head 45 through the switching circuit 14.

(0015)

The servo control is basically the same as at the time of analog recording. Basically, the recording control signal that has been synchronized with the digital input

signal is produced at the control signal generating circuit 40 to be recorded on the magnetic tape 52. This control signal is used as a reference signal for the rotation phase of the cylinder 55 at the time of reproduction. A pulse generator PG is installed at a position which is 180-degree phase separated and this detection pulse is used for the detection of the rotation phase of the cylinder 55 and as the output switching signal of the magnetic heads 53 and 53'.

Meanwhile, the servo control circuit 65 acts in such a fashion as to maintain the control signal that has been reproduced by the control head 45 and the said detection pulse in a prescribed phase relationship. At this time, the reproduction control signal that will become a reference signal uses only one edge such as the stand-up edge, to cite an example.

(0016)

Next, the reproduction signal processing of the digital signal will be explained below. The outputs of the magnetic heads 53 and 53' are sent to the switching circuit 12 through the reproduction amplifier 57. The replay control signal that is reproduced at the control head 45 is inputted to the discrimination circuit 60 and the servo control circuit 65 through the switching circuit 14.

The switching circuit 14 switches in such a way that, at the time of reproduction, it may be connected to the control head 45, the discriminating circuit 60 and the servo control circuit 65. At the discriminating circuit 60, the kind of the signal that is recorded from the reproduction control signal is discriminated and, in

conformity with said result and the reproduction control signal, the servo control circuit 65 carries out the control on the prescribed tape forwarding speed and the cylinder rotation number, etc.

On the basis of the discrimination result of the discriminating circuit 60, moreover, the switching circuit 12 is automatically switched so as to connect the reproduction amplifier 57 and the digital signal proces sing circuit 70 of the reproduction system and the switching circuit 13 is switched automatically so as to connect the digital signal processing circuit 70 of the reproduction system and the output terminal 5.

The structure of the circuit 60 and the circuit action of same discriminating circuit 60 will be described in detail later.

The replay digital signal is inputted to the digital signal processing circuit 70 of the reproduction system, where a prescribed reproduction signal processing is carried out. Basically, the reproduction signal is digitally demodulated and error correction is carried out by using an error correcting sign that was added at the time of recording.

The reproduction digital signal that has been replay-signal processed as described above is outputted from the output terminal 5 through the switching circuit 13 from the digital signal processing circuit 70 of the replay system.

(0017)

By providing both the signal processing circuits for analog recording and digital recording as described above, it becomes possible to realize a VTR which can be used as an analog VTR of the conventional system, while being

capable of digital recording and reproducing. It is belived that various kinds of digital video services will be introduced into the market in the future. It will be able to cope with them by being equipped with a signal processing circuit that will carry out the signal processing of such formats as will conform to them.

(0018)

In the case of such a VTR, it is believed that there are cases where an analog-recorded part and a digital-recorded part may be mixed on the same recording medium. Nevertheless, it is not easy for the user to discriminate the kinds of signals that have been recorded at the time of reproduction for switching the replay mode by himself.

In the case of a VTR that copes with a plurality of digital video services as described above, moreover, the automatic discrimination of the recording signal at the time of replay is essential.

(0019)

A method of discriminating the recording signals by using a control signal according to this invention will be explained below.

As has been described earlier, the control signal is used as a reference signal for servo control. However, it is one edge (the stand-up edge in the example) which is actually used as a reference. According to this invention, therefore, recording is effected by changing the polarity changing point and the duty ratio of the control signal to be recorded. An example of the

recording of an analog signal is shown in Figure 3. In the case where an analog signal is to be recorded as described above, for instance, a control signal whose duty ratio is 50 per cent is recorded as is shown in Figure 2(2) and, in the case of a digital signal, a control signal with the polarity changing point being different from the analog recording time as shown in Figure 3(2) is recorded.

In the above case, the output of the control head 45 and the reproduction control signal that are obtained by the reproduction of the digital signal at this time will be as shown in Figures 3 (6) and (7). As described earlier, the servo control only uses one edge (the standup edge of the control signal in this example) of the reproduction control signal. Accordingly, the recording of control signals with different duty ratios as described earlier will not have any effect whatsoever on the servo control.

In this example, an explanation has been given in the case where the standup edge of the control signal has been used as a reference signal. However, this is not the only applicable example. By changing the polarity changing points of the edge and the opposite edge to be used as the reference signal for the servo, it becomes possible to carry out the discrimination of the data without exerting any effect whatsoever on the servo control.

(0020)

By changing the polarity changing point of the control signal at the time of recording and detecting the difference in this polarity changing point at the time of reproduction

as described above, it becomes possible to discriminate the recording signal. Figure 4 shows an example of the constitution of a discriminating circuit 60.

In Figure 4, numeral 100 indicates an input terminal of an output from the control head 45, 110 is a waveform restoration circuit for the head output and for the detection of the standup edge and the stand-down edge of the control signal, 120 is a single-stabilized multi-vibrator, and 130 is a flipflop.

The circuit action will be explained by referring to Figures 5 and 6. Figure 5 shows the case of analog recording and Figure 6 shows the case of digital recording, both shown for the purpose of explaining the circuit actions involved.

First, the case of analog recording will be explained. The replay output (refer to Figure 5 (1)) of the control head 45 is inputted from the input terminal 100 of the discriminating circuit 60 to be sent to a waveform restoration circuit 120. At the waveform restoration circuit 120, the signals with the standup and standdown edges having been restored (refer to Figures 5 (a) and (3)) are outputted.

The signal CU that has detected the standup (refer to Figure 5 (2)) is the same as the replay control signal shown in Figure 3 (7). Signal CU drives the single-stabilized multi-vibrator 120, thereby obtaining an output signal JG having a prescribed pulse width (tau) (refer to Figure 5 (4)). In this case, the prescribed pulse width (tau) is determined by the polarity changing point of the control signal that is recorded; it is longer than

the time (tau)2 (which is shown in Figure 6) from the standup edge to the stand-down edge at the time of digital recording but is shorter than the time (tau)1 at the time of analog recording (shown in Figure 5).

The signal CD that has detected the stand-down edge of the signal JG and the control signal (refer to Figure 5 (3)) (Translator's Note: Due to the intrinsic ambiguity of the Japanese sentence structure, the foregoing can be translated as "The signal JG and the signal CD that has detected the stand-down edge of the control signal (refer to Figure 5(3))" are inputted to the D flipflop 130.

The D flipflop 130 outputs the polarity of the signal JG at the time of the stand-down of the control signal. In the example shown in Figure 5, it is set in such a fashion that the pulse width of the signal JG or (tau) will be as follows:

(tau)2 is smaller than (tau), which is smaller than (tau)1,

Therefore, the output of the D flipflop 130 or the polarity of the discriminating signal will be on the Low level.

(0021)

The case of digital recording will be explained below by referring to Figure 6. The reproduced output of the control head 45 (refer to Figure 6 (1)) is inputted from the input terminal 100 of the discriminating circuit 60 to be sent to the waveform restoration circuit 120. The waveform restoration circuit 120 outputs the signals with the standup and stand-down edges having been restored respectively (refer to Figures 6 (2) and (3).)

The signal CU that has detected the stand-up (refer to Figure 6 (2)) is the same as the reproduction control signal shown in Figure 3 (7). The single-stabilized multivibrator 120 is driven by the signal CU and an output signal JG having a prescribed pulse width (tau) (refer to Figure 6 (4)) is obtained. In this case, the prescribed pulse width (tau) is decided by the polarity changing point of the control signal and it is longer than the time (tau)1 (refer to Figure 6) from the stand-up edge to the stand-down edge at the time of digital recording but is shorter than the time (tau)2 (shown in Figure 5) at the time of analog recording.

The signal JG and the signal CD that has detected the stand-down edge of the control signal (refer to Figure 6 (3)) are inputted to the D flipflop 130. The D flipflop 130 outputs the polarity of the signal JG at the time of the stand-down of the control signal. In an example shown in Figure 6, the pulse width (tau) of the signal JG is set to satisfy the following:

(tau)2 is smaller than (tau), which is smaller than (tau)1

with a result that the output of the D flipflop 130 or the polarity of the discriminating signal is on the High level.

By detecting the difference in the polarity changing point of the control signal in this manner, it becomes possible to automatically discriminate the kind of the signal that is recorded at the time of reproduction.

According to the method of this invention, it can be used as a discriminating signal for the recording signal without adversely affecting it as a reference signal

for servo control which is the purpose of the control signal according to prior art in any way whatsoever.

(0022)

Figure 7 is a figure shown for the purpose of explaining the action in the case where the time (tau)3 from the stand-up edge to the stand-down edge of the control signal at the time of digital recording is made longer than the time (tau)1 at the time of analog recording. In this case, the pulse width (tau) of the single-stability multi-vibrator 120 is set in such a way as to satisfy the following:

(tau)1 is smaller than (tau)m which is smaller than (tau)3

At this time, the polarity of the discriminating signal becomes Low in the case of digital recording and the polarity of the discriminating signal becomes High in the case of analog recording. In this manner, it becomes possible to discriminate the recording signals as in the case which is shown in Figure 6, despite the fact that the polarities of the discriminating signals are different.

However, the maximum time required for disrimination in the example shown in Figure 6 is (tau)1, whereas the maximum time in the example shown in Figure 7 is (tau)3. It is mentioned in this connection that, at the time when the control signal is modified for recording, the time required for discrimination can be held to the minimum by changing the control signal before the polarity changing point ((tau)1) of the control signal at the time of analog recording as in the example shown in Figure 7.

(0023)

In this example, a VTR capable of recording one kind of analog recording and one kind of digital recording has been used. As the video information services that will become input signals, several kinds including the satellite broadcast and the cable television, etc. are conceivable. Accordingly, there is a possibility for the VTR to cope with not only two kinds of signals but also a larger number of signals. Even in such a case, it becomes possible to discriminate the recording signals without any problem at the time of reproduction by changing the polarity changing point of the control signal in conformity with the respective signals.

(0024)

Figure 8 shows an example of the constitution of a discriminating circuit 60 in the case where three kinds of signals are to be discriminated. In Figure 8, numeral 100 indicates an input terminal, 110 is a waveform restoration circuit, 120 is a single-stability multi-vibrator, 130 is a D flipflop, 140 is a discrimination pulse generating circuit which is constituted by a single stability multi-vibrator 120 and a D flipflop 130, 141 is a single stability multi-vibrator which is the same as 140, and 105 is an output terminal for the discriminating signal.

The basic action involved is the same as in the case of the discriminating circuit shown in Figure 4. What makes it different is the fact that the output pulse width of the single stability multi-vibrator that constitutes the discriminating pulse generating circuits 140 and 141 is set in conformity with the polarity changing point of the control signal at the time of recording.

The action of the discriminating circuit 60 which is shown in Figure 8 will be briefly explained below by referring to Figure 9.

The reproduction control signal that has been inputted from the input terminal 100 is sent to a waveform restoration circuit 110. The reproduction control signal changes the polarity changing point in conformity with the recording signal or, in other words, changes the duty ratio, so as to effect recording.

Figures 9 (1), (2) and (3) show the reproduction control signals in various cases. The time ranging from the stand-up edge to the stand-down edge of the control signal is various at (tau)1, (tau)2 and (tau)3 for the recording signals 1, 2 and 3 respectively.

The above-described reproduction control signal is restored to the signal CU showing the stand-up edge and the signal CD showing the stand-down edge at the waveform restoration circuit 110 to be inputted to a discriminating pulse generating circuits 140 and 141.

At the discriminating pulse generating circuits 140 and 141, the output pulse widths of the single-stability multi-vibrator are set at (tau)a and (tau)b respectively (refer to Figures 9 (8) and (9)) and same is driven by the stand-up edge of the control signal. Here, the pulse widths of the single-stability multi-vibrator are set to satisfy the following:

3 is smaller than (tau)a, which is smaller than (tau)2, which is smaller than (tau)1

Because of the above, the outputs J1 and J2 of the discriminating pulse generating circuits 140 and 141 will

become as follows:

In the case of the recording signal 1, the reproduction control signal will be as shown in Figure 9(2), with a result that J1 = Low and J2 = High are obtained.

In the case of the recording signal 2, the reproduction control signal will be as shown in Figure 9 (5), where J1 = Low and J2 = Low are obtained.

In the case of the recording signal 3, moreover, the reproduction control signal will be as shown in Figure 9(7), where J1 = High and J2 = High, with discrimination being possible.

Through recording by changing the polarity changing point of the control signal in conformity with the recording signal as described above, it becomes possible to discriminate the recording signals on an automatic basis at the time of reproduction.

(0025)

The discriminating circuit according to this example is constituted by a single-stability multi-vibrator. However, this invention is not limited to this alone. It works satisfactorily as long as the circuit constitution is such as is capable of detecting the difference in the polarity changing point and the duty ratio of the reproduction control signal.

(0026)

The above-described discriminating method using a control signal has the following advantage:

It becomes possible to comparatively freely set the format suitable for the recording signal, provided that the recording area of the control signal on the recor-

ding medium is appropriately set.

For example, the tape speed is changed in conformity with the amount of the information to be recorded and even if the incline of the recording track, etc. may change for the video information, there is no effect whatsoever on the control track, with a result that it becomes possible to accurately discriminate the recording signal.

(0027)

The channel division recording has not been dwelled upon in this example; however, it is effective even in the case of channel division recording.

(0028)

(Effect of the Invention)

According to this invention which has been explained above, an information recording and reproducing device capable of both analog recording and digital recording can be realized and, at the same time, it becomes also possible to automatically carry out the discrimination of the recording signal at the time of reproduction, thereby offering a recording and reproducing device which can be conveniently used by the user.

In addition, it is possible to discriminate the recording signals, provided that interchangeability of the recording ranges of the control signal is maintained, with a result that the degree of freedom at the time of the decision of the recording format is comparatively high.

(Concise EXplanation of the Drawings)

(Figure 1)

This is a block diagram showing an example of this invention.

(Figure 2)

This is a figure shown for the purpose of explaining servo control at the time of analog recording.

(Figure 3)

This is a figure shown for the purpose of explaining the servo control at the time of digital recording.

(Figure 4)

This is a block diagram showing an example of the constitution of a discriminating circuit 60.

(Figure 5)

This is a signal waveform shown for the purpose of explaining the action of the discriminating circuit 60 at the time of analog recording.

(Figure 6)

This is a signal waveform shown for the purpose of explaining the action of the discriminating circuit 60 at the time of digital recording.

(Figure 7)

This is a signal waveform shown for the purpose of explaining the action of the discriminating circuit 60 at the time of digital recording.

(Figure 8)

This is a block diagram showing an example of the constitution of the discriminating circuit 60 to cope with plural kinds of signals.

(Figure 9)

This is a signal waveform shown for the purpose of explaining the action of the discriminating circuit 60 shown in Figure 8.

(Explanation of the Codes Used)

20. Digital signal processubg circuit of the recording system

30. Analog signal processing circuit of the recording system

10, 11, 12, 13 and 14. Switching circuits

40. Control signal generating circuit

65. Servo control circuit

60. Discriminating circuit

70. Digital signal processing circuit of the reproduction system

80. Analog signal processing circuit of the reproduction system

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(Insert Figure 1 on p. (7). 20. Digital signal processing of the recording system. 30. ANalog signal processing of the recording system. 40. CTL generation. 65/ Servo. 60. (Translator's Note: Four characters are illegible). 70. Digital signal processing of the reproduction system. 80. Analog signal processing of the reproduction system.)

(Insert Figure 2 on p. (7). (1) Input ... (Translator's Note: two characters are illegible). (2). (Translator's Note: two characters are illegible) ... control. (5) Head. (6) Control .... (7) Reproduction ...)

(Insert Figure 3 on p. (7). (1) Input ... (Translator's Note: Two characters are illegible). (2). (Illegible). (5) Head ... (Translator's Note: Four characters are illegible). (7) (Translator's Note: two characters are illegible).)

(Insert Figure 4 on p. (7). 120. Single stability multivibrator. 110. (Translator's Note: Four characters are illegible).)

(Insert Figure 5 on p. (7). (5) (Translator's Note: two characters are illegible).

(Insert Figure 6 on p. (8). (5) (Illegible).)